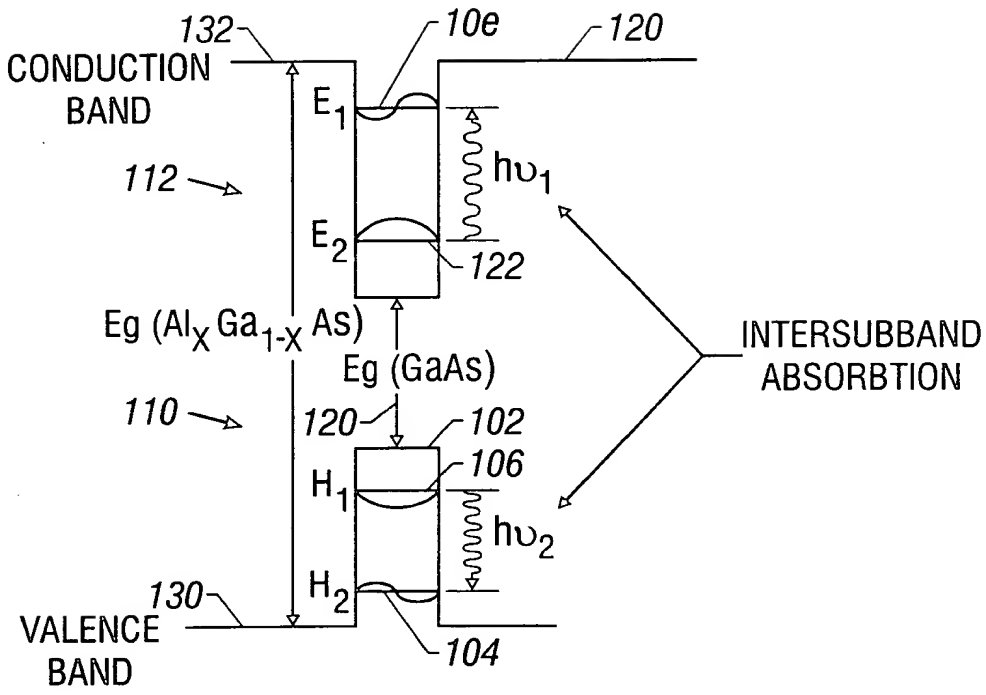

132
10e
120
CONDUCTION BAND
E_1
$h\upsilon_1$
112
E_2
122
Eg (Al_X Ga_{1-X} As)
Eg (GaAs)
INTERSUBBAND ABSORBTION
110
120
102
106
H_1
$h\upsilon_2$
H_2
130
VALENCE BAND
104

FIG. 1

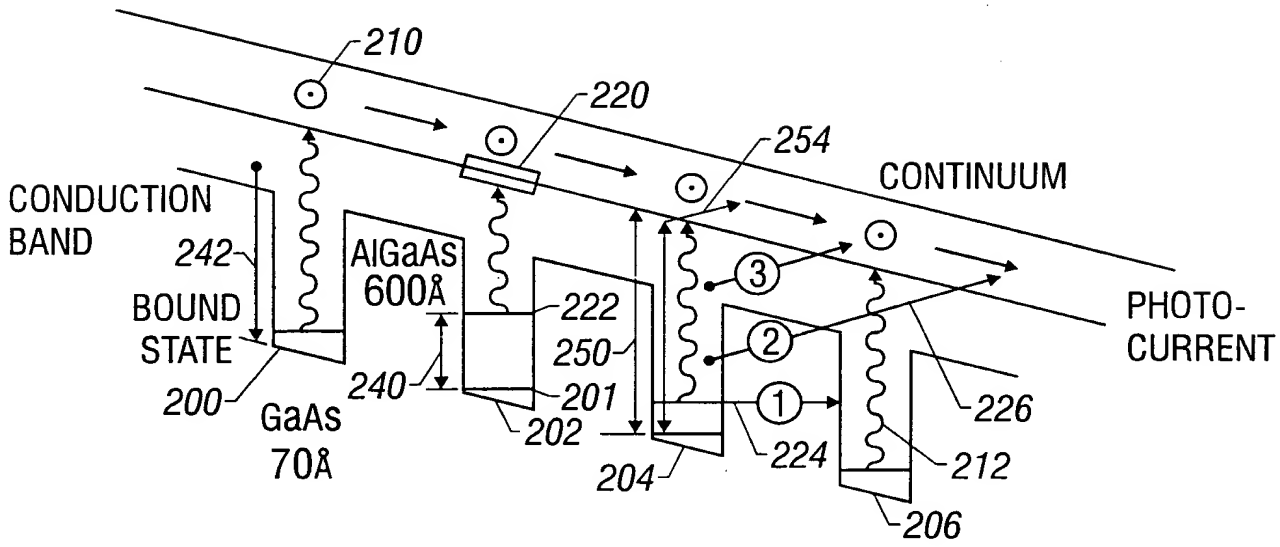

210
220
254
CONTINUUM
CONDUCTION
BAND
242
AlGaAs
600Å
BOUND
STATE
222
250
PHOTO-
CURRENT
240
201
200
GaAs
70Å
202
226
224
212
204
206

FIG. 2

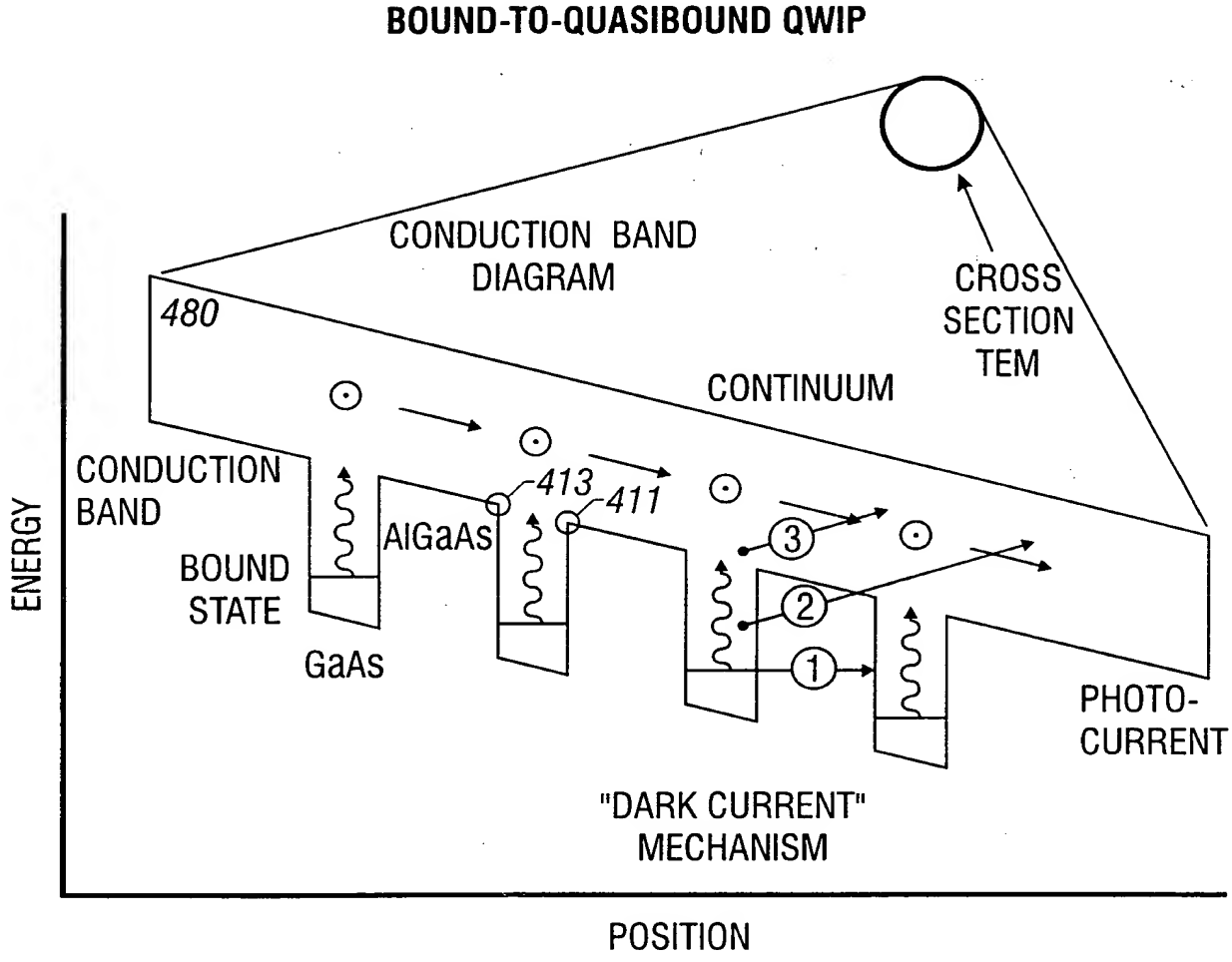

BOUND-TO-QUASIBOUND QWIP
CONDUCTION BAND DIAGRAM
480
CROSS SECTION TEM
CONTINUUM
CONDUCTION BAND
413
411
AlGaAs
BOUND STATE
GaAs
3
2
1
PHOTO-CURRENT
"DARK CURRENT" MECHANISM
ENERGY
POSITION

FIG. 3A

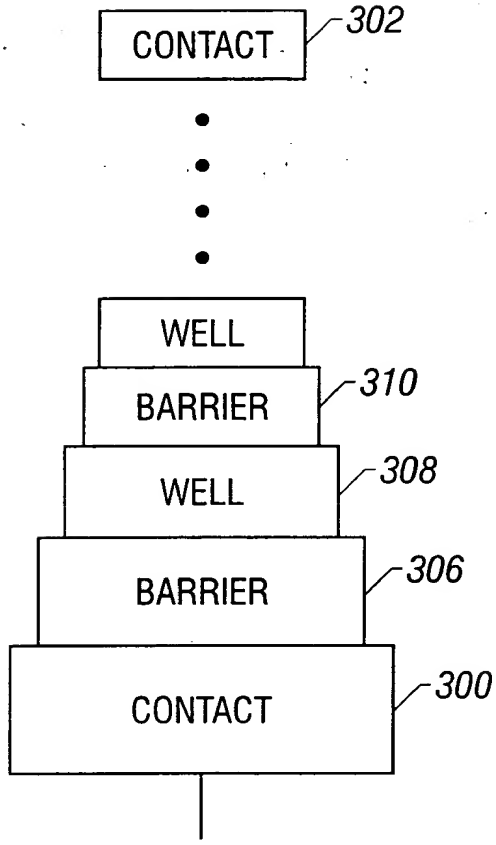

CONTACT
302
WELL
BARRIER
310
WELL
308
BARRIER
306
CONTACT
300

FIG. 3B

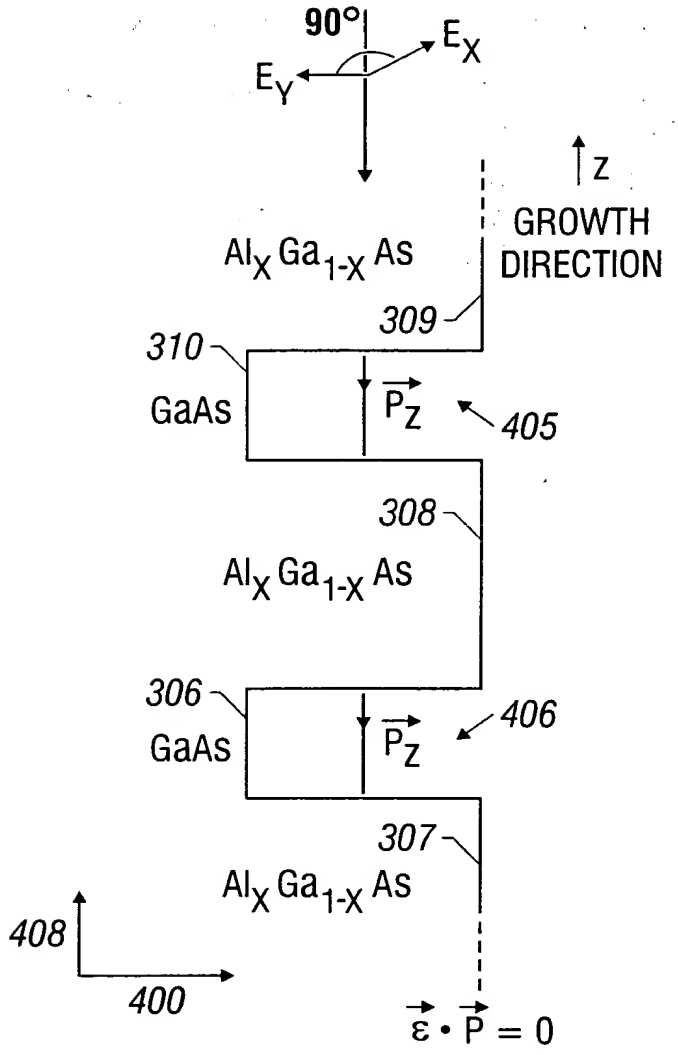

90°
E_X
E_Y
z
GROWTH DIRECTION
$Al_X Ga_{1-X} As$
309
310
GaAs
$\vec{P}_Z$
405
308
$Al_X Ga_{1-X} As$
306
GaAs
$\vec{P}_Z$
406
307
$Al_X Ga_{1-X} As$
408
400
$\vec{\varepsilon} \cdot \vec{P} = 0$

FIG. 4

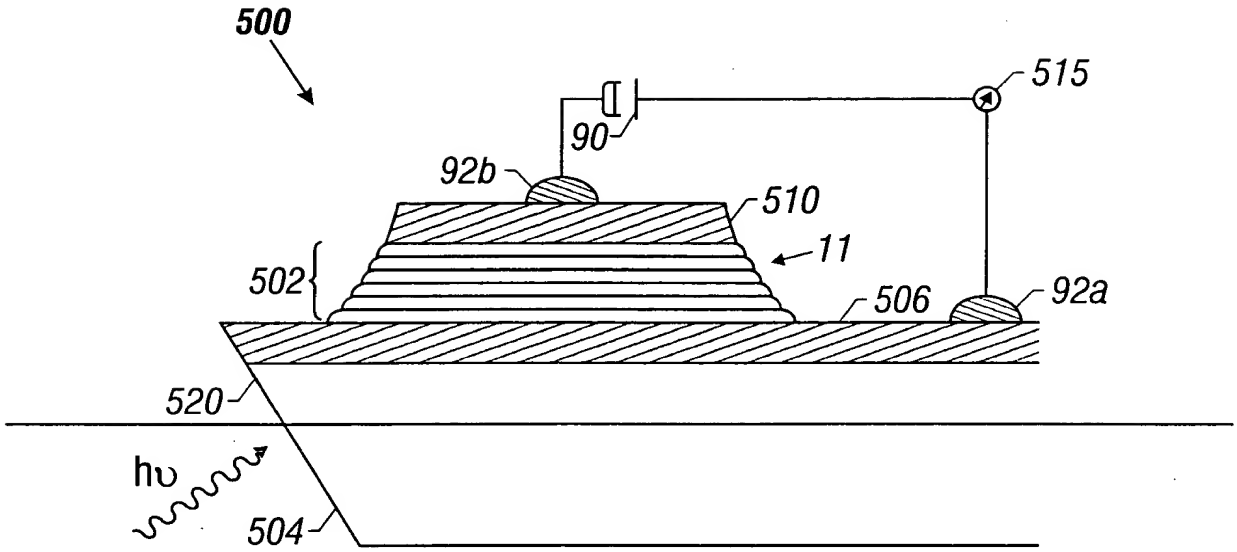


FIG. 5

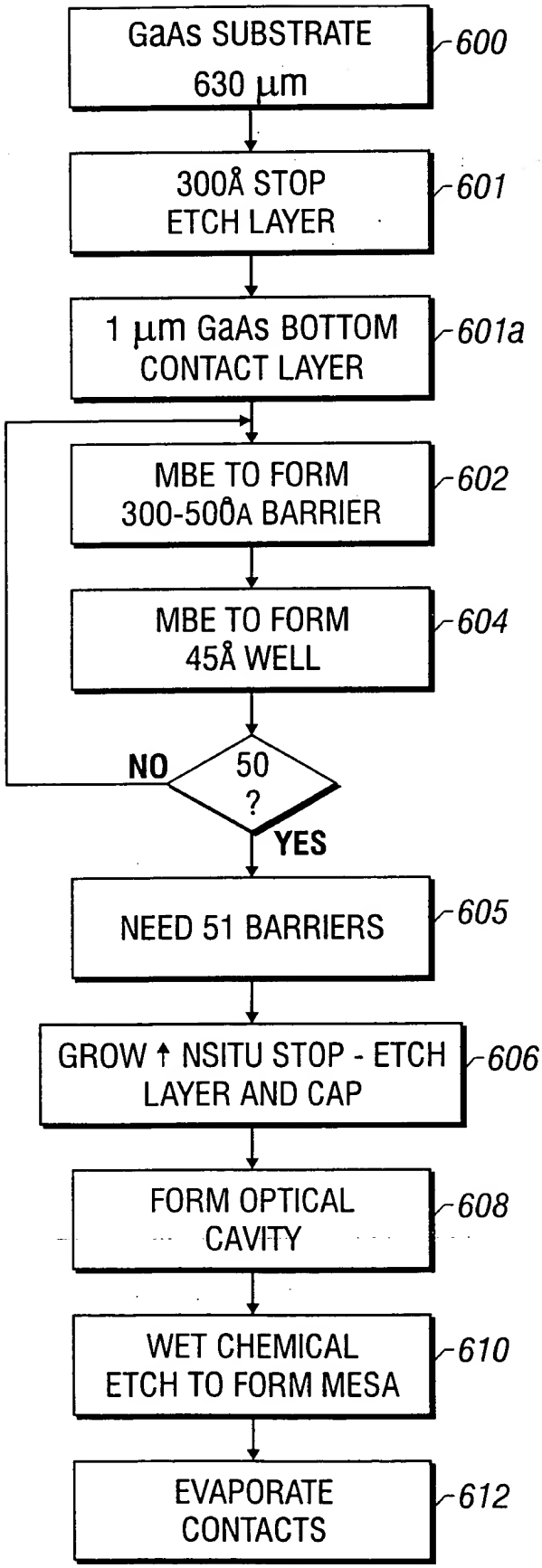

GaAs SUBSTRATE
630 μm
600
300Å STOP
ETCH LAYER
601
1 μm GaAs BOTTOM
CONTACT LAYER
601a
MBE TO FORM
300-500Å BARRIER
602
MBE TO FORM
45Å WELL
604
NO
50
?
YES
NEED 51 BARRIERS
605
GROW ↑ NSITU STOP - ETCH
LAYER AND CAP
606
FORM OPTICAL
CAVITY
608
WET CHEMICAL
ETCH TO FORM MESA
610
EVAPORATE
CONTACTS
612

FIG. 6

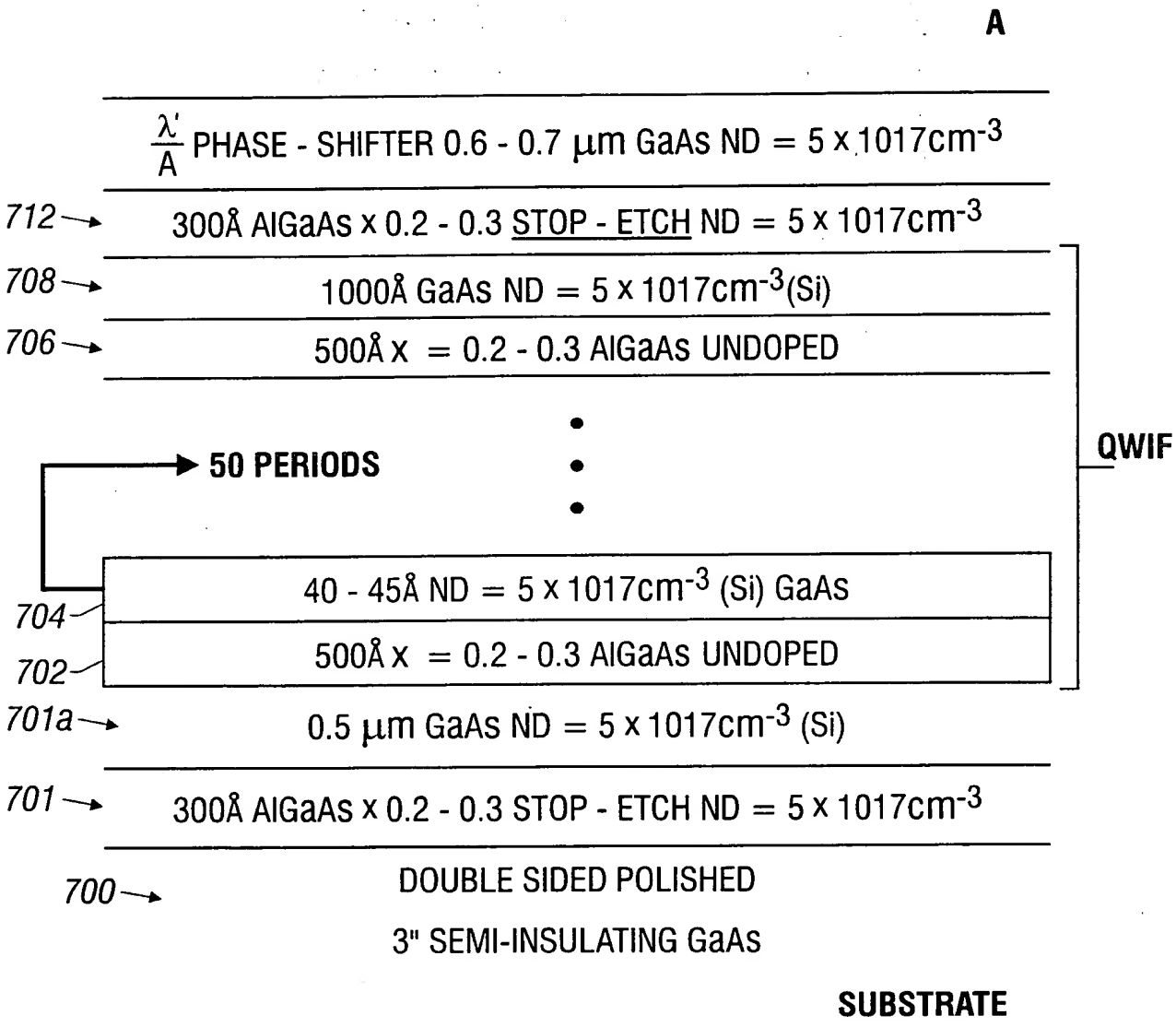
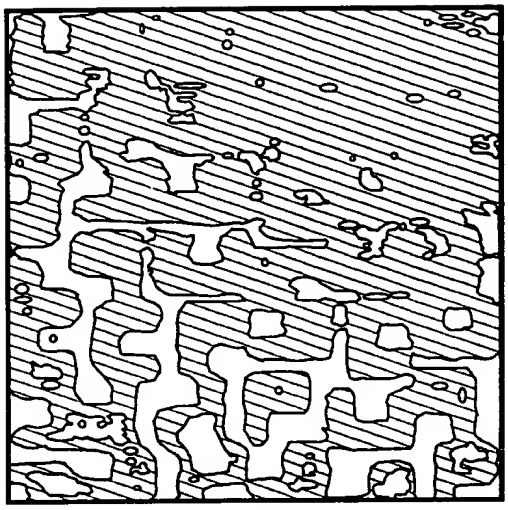

A
$\frac{\lambda'}{A}$ PHASE - SHIFTER 0.6 - 0.7 μm GaAs ND = 5 x 1017cm^{-3}
712
300Å AlGaAs x 0.2 - 0.3 STOP - ETCH ND = 5 x 1017cm^{-3}
708
1000Å GaAs ND = 5 x 1017cm^{-3}(Si)
706
500Å x = 0.2 - 0.3 AlGaAs UNDOPED
50 PERIODS
QWIF
704
40 - 45Å ND = 5 x 1017cm^{-3} (Si) GaAs
702
500Å x = 0.2 - 0.3 AlGaAs UNDOPED
701a
0.5 μm GaAs ND = 5 x 1017cm^{-3} (Si)
701
300Å AlGaAs x 0.2 - 0.3 STOP - ETCH ND = 5 x 1017cm^{-3}
700
DOUBLE SIDED POLISHED
3" SEMI-INSULATING GaAs
SUBSTRATE

FIG. 7

A



B

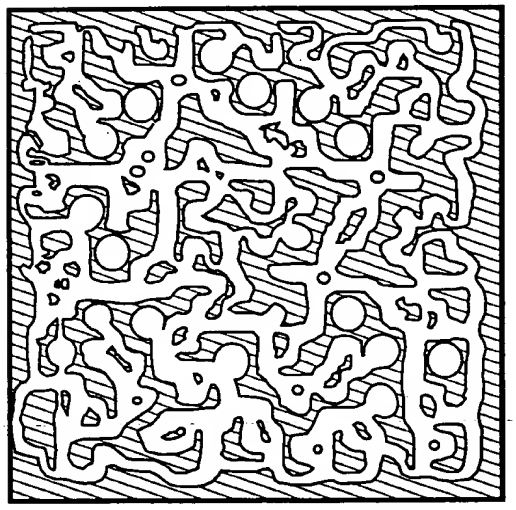


FIG. 7A

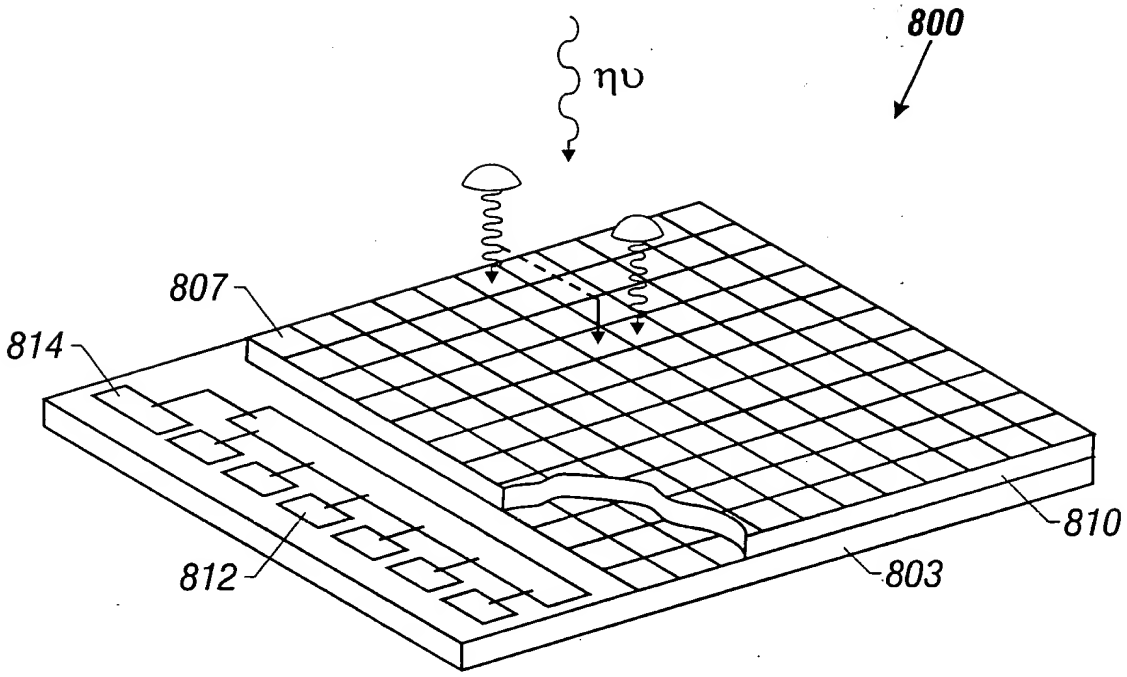


FIG. 8

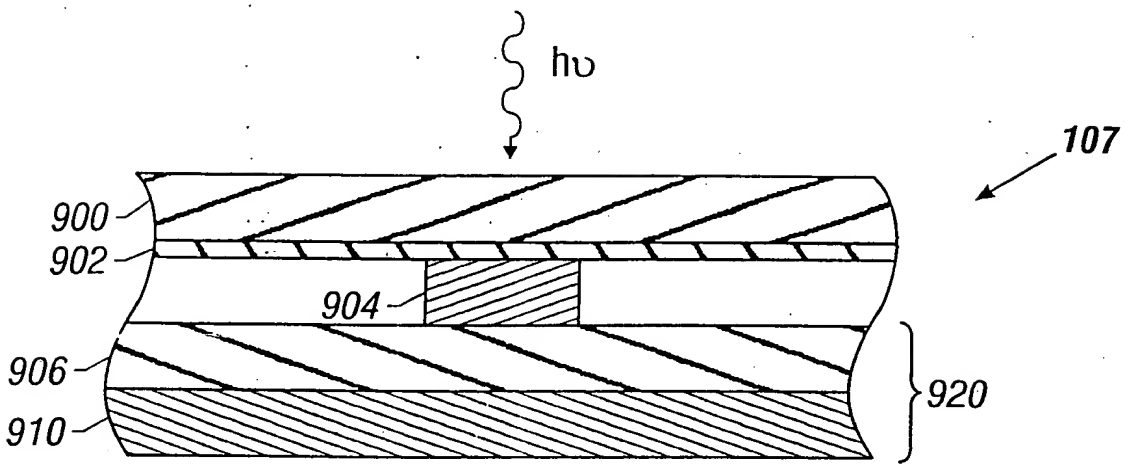


FIG. 9

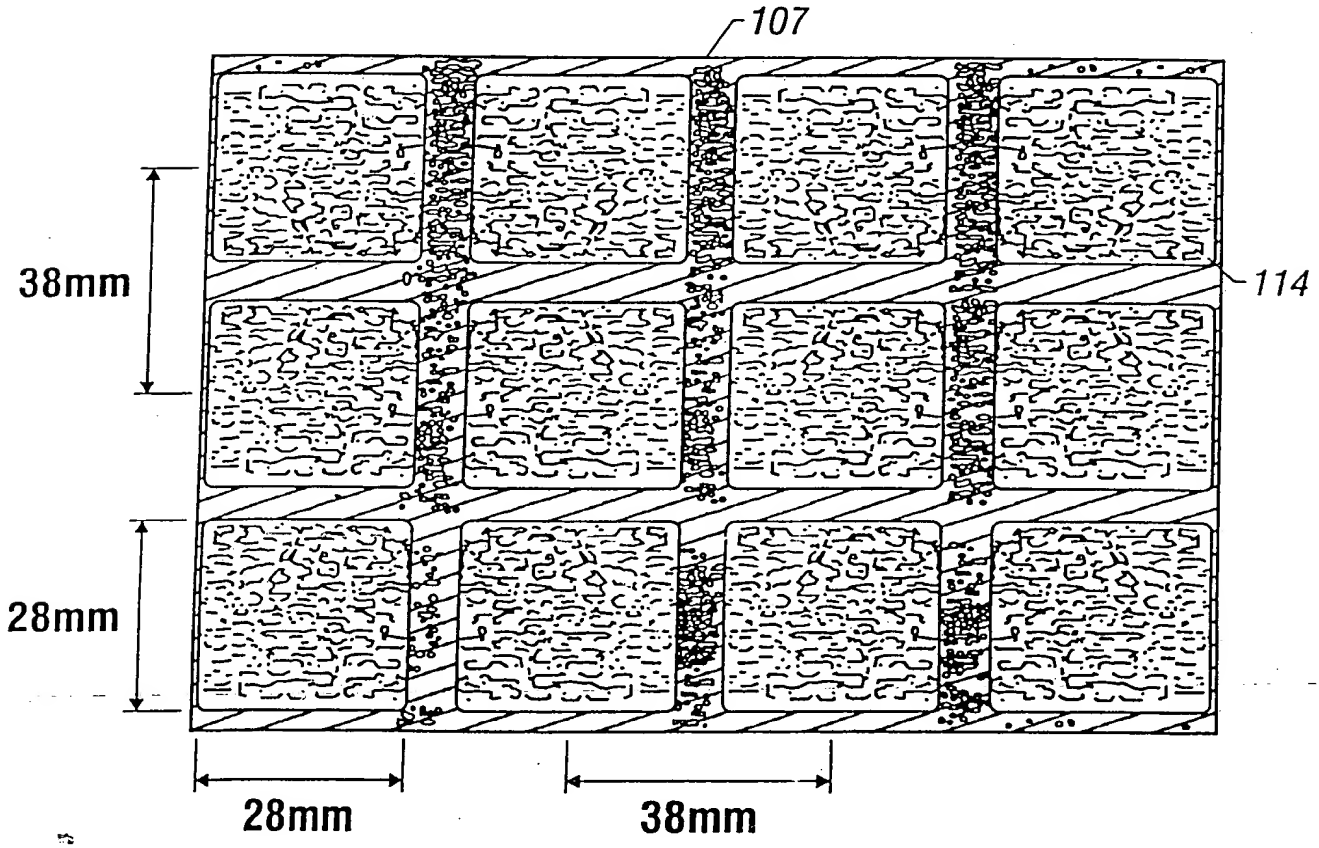


FIG. 10

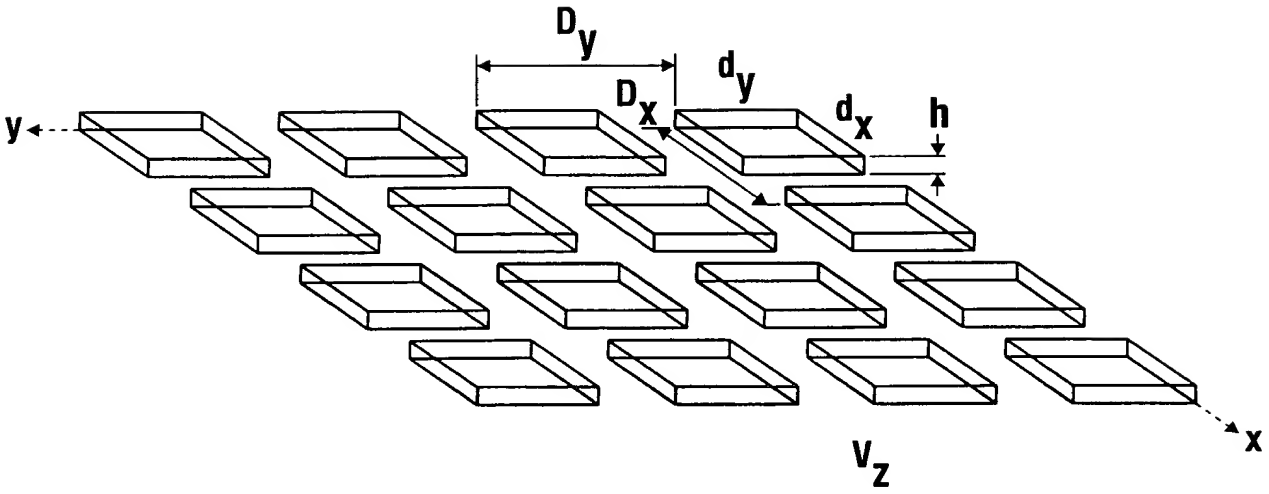


FIG. 10A

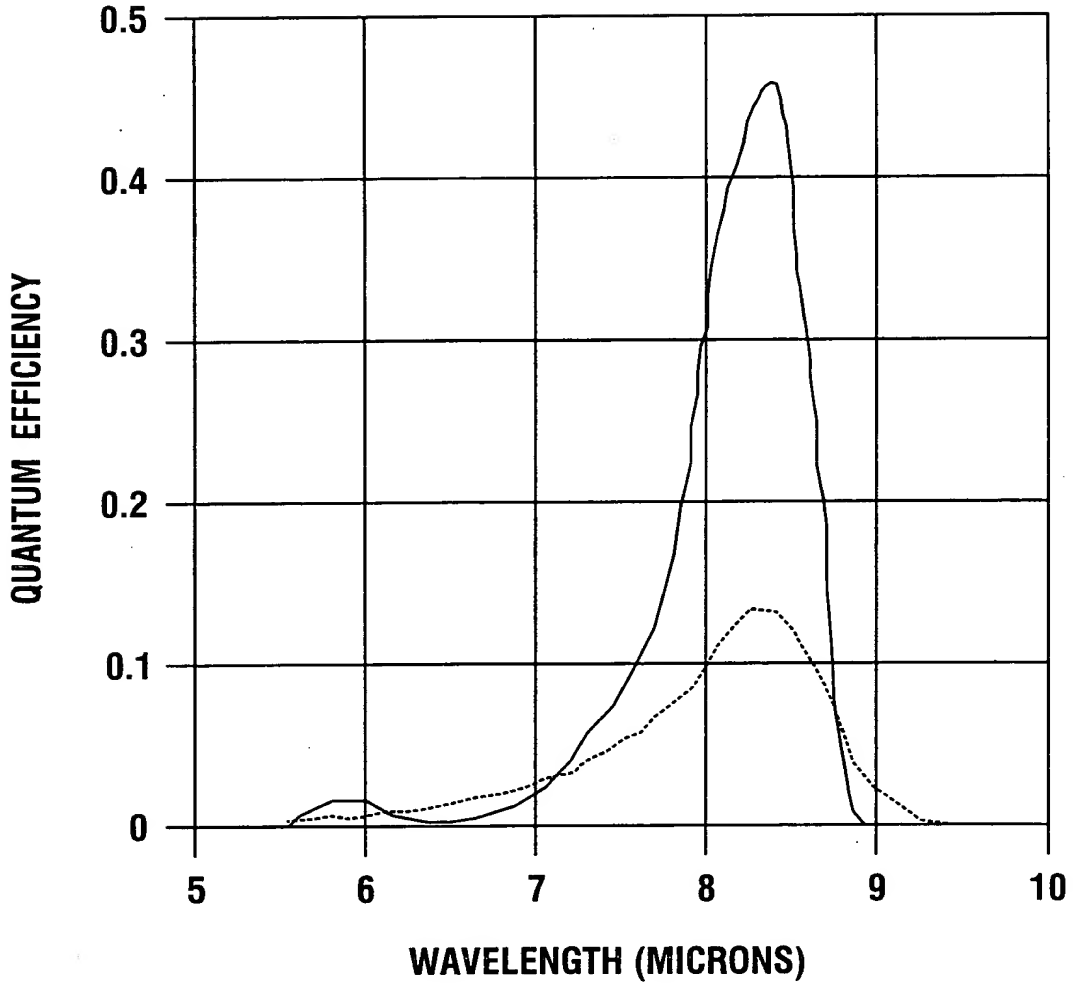

0.5
0.4
0.3
0.2
0.1
0
QUANTUM EFFICIENCY
5
6
7
8
9
10
WAVELENGTH (MICRONS)

FIG. 10B

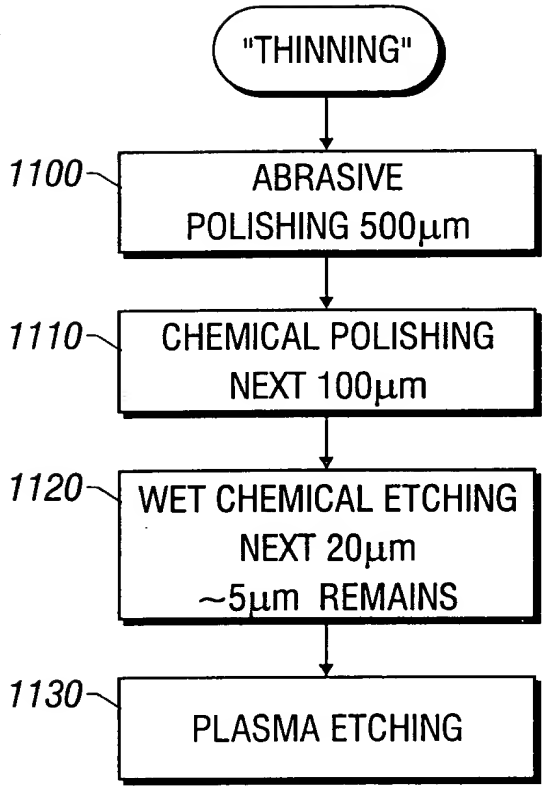

"THINNING"
1100
ABRASIVE POLISHING 500μm
1110
CHEMICAL POLISHING NEXT 100μm
1120
WET CHEMICAL ETCHING NEXT 20μm ~5μm REMAINS
1130
PLASMA ETCHING

FIG. 11